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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/797,046	03/11/2004	Jung-hyun Lee	030681-634	4688
21839 7590 07/12/2007 BUCHANAN, INGERSOLL & ROONEY PC POST OFFICE BOX 1404 ALEXANDRIA, VA 22313-1404			EXAMINER CRANE, SARA W	
			ART UNIT 2811	PAPER NUMBER
			MAIL DATE 07/12/2007	DELIVERY MODE PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/797,046	LEE ET AL.	
	Examiner	Art Unit	
	Sara W. Crane	2811	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
 - If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
 - Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 17 April 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 22 and 23 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 22 and 23 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>4/17/2007</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Seidl et al., US 2002/0014647, in view of Lee et al., 7,112,539.

As noted in the previous Office action of 11/30/2006, the Seidl reference teaches a capacitor (a trench capacitor, see the figures and the abstract). The lower electrode is the semiconductor region surrounding the trench (60, figures 1, abstract), and the upper electrode is the trench fill material (80). The list of possible dielectric materials is on page 2, [0028]. It would have been obvious to incorporate a dielectric layer of Al-Hf-O, because that is one of the materials listed.

Lee et al. teaches to form a multi-layer dielectric material, suitable for capacitors (column 3, lines 60-64), in order to improve interface properties and to improve fixed charge in the layers (column 6, lines 12-18). It would have been obvious to include multiple dielectric materials in the capacitor dielectric, for reasons noted in this reference. It would have been obvious to include a material having higher dielectric constant, in order to increase the effective dielectric constant of the multi-layer dielectric. Because the reference teaches a multi-layer dielectric of layer pairs (column 3, lines 1-2), at least one layer of any material will be formed over at least one layer of the other material. Also, dielectric materials for capacitors often have a second, or

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subsequent, layer formed above, because such a layer will cover any pinholes or defects in the lower layer.

Claim 23 is rejected under 35 U.S.C. 103(a) as being unpatentable over Seidl et al. in view of Lee et al. and Chooi et al., 6,486,080.

Column 2, lines 16-20, of Chooi et al. teaches to form hafnium oxide over a silicon nitride oxidation barrier. It would have been obvious to form the aluminum hafnium oxide of Seidl et al. over a silicon nitride oxidation barrier, because if hafnium oxide is improved by such a barrier, then aluminum hafnium oxide would also be improved, because this material comprises hafnium oxide.

Conclusion

Applicant notes in the remarks of 4/17/2007 that the previous Office action does not allege any suggestion as to why one would combine an AHO dielectric film with a second dielectric film having a higher dielectric constant. The previous Office action stated, "It would have been obvious to include a material having higher dielectric constant, in order to increase the effective dielectric constant of the multi-layer dielectric." The idea is, if high k is good, then higher k is better. The higher the effective dielectric constant of a capacitor, the more charge it can store in a given volume. This is simple physics, and would appear to be sufficient prima facie basis for modifying or extending a reference teaching. Note that the motivation to modify a reference teaching

can derive from knowledge generally available to one of ordinary skill in the art (and need not be a specific teaching of a reference). MPEP 2142. Also, applicant's specification does not appear to set forth any advantages at all associated with choosing a higher dielectric constant for a second layer in a composite capacitor dielectric. So there is no teaching in the specification that could be relied upon to overcome a prima facie showing of obviousness.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to S. Crane, whose telephone number is (571) 272-1652.

The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Sara W. Crane
Primary Examiner
Art Unit 2811